

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Original): A microelectronic contact structure, comprising:

a plurality of column elements, wherein each of said plurality of column elements has a top and a base, and wherein said bases are positioned for attachment to a substrate; and
a contact element joined to each of said column elements.

Claim 2 (Original): The microelectronic contact structure of Claim 1, wherein said contact element further comprises a beam formed of a resilient material.

Claim 3 (Original): The microelectronic contact structure of Claim 1, wherein said contact element further comprises a contact pad joined to each of said column elements adjacent to said tops thereof.

Claim 4 (Original): The microelectronic contact structure of Claim 1, wherein said column elements are substantially straight and parallel to one another.

Claim 5 (Currently amended): The microelectronic contact structure of ~~Claim 12~~ Claim 2, wherein said beam is positioned transverse to each of said plurality of column elements and joined to each of said column elements adjacent to said tops thereof.

Claim 6 (Original): The microelectronic contact structure of Claim 1, wherein said column elements are inclined to said contact element at an angle between 70° and 110°.

Claim 7 (Original): The microelectronic contact structure of Claim 1, wherein said column elements are perpendicular to said contact element.

Claim 8 (Original): The microelectronic contact structure of Claim 1, wherein each of said column elements is substantially cylindrical.

Claim 9 (Withdrawn): The microelectronic contact structure of Claim 2, wherein said beam is sloped away from said top of said column elements.

Claim 10 (Original): The mi2.croelectronic contact structure of Claim 2, further comprising a sacrificial substrate joined to said beam.

Claim 11 (Original): The microelectronic contact structure of Claim 2, wherein said beam is contoured.

Claim 12 (Original): The microelectronic contact structure of Claim 1, wherein each of said column elements comprises a segment of wire.

Claim 13 (Original): The microelectronic contact structure of Claim 2, wherein said beam is fabricated by a lithographic process that includes depositing said resilient material on a sacrificial substrate.

Claim 14 (Original): The microelectronic contact structure of Claim 2, further comprising a tip structure positioned on a surface of said beam opposite to said group of column elements.

Claim 15 (Original): The microelectronic contact structure of Claim 14, wherein said tip structure is positioned over said group of column elements.

Claim 16 (Withdrawn): The microelectronic contact structure of Claim 15, further comprising a substrate joined to each of said column elements at said base thereof, wherein said plurality of column elements are arranged in a group and configured such that said top of each of said column elements will deflect towards said substrate when a force towards said substrate is applied to said tip, whereby said microelectronic contact structure is resilient.

Claim 17 (Original): The microelectronic contact structure of Claim 16, wherein said beam has a free end cantilevered from said group of column elements.

Claim 18 (Original): The mi10.croelectronic contact structure of Claim 17, further comprising a tip structure positioned on said beam between said free end of said beam and said group of column elements.

Claim 19 (Original): The microelectronic contact structure of Claim 18, wherein said tip structure is positioned on a surface of said beam opposite to said group of column elements.

Claim 20 (Original): The microelectronic contact structure of Claim 18, wherein said tip structure is positioned adjacent to said free end of said beam.

Claim 21 (Original): The microelectronic contact structure of Claim 18, wherein said tip structure comprises a stand-off mounted to said beam, and a contact tip mounted to said stand-off.

Claim 22 (Original): The microelectronic contact structure of Claim 1, wherein each of said column elements comprises a wire core enclosed in a shell comprising at least one shell material.

Claim 23 (Original): The microelectronic contact structure of Claim 22, wherein said wire cores are comprised of a material less rigid than said at least one shell material.

Claim 24 (Original): The microelectronic contact structure of Claim 22, wherein said wire cores are comprised of a material more rigid than said at least one shell material.

Claim 25 (Original): The microelectronic contact structure of Claim 22, wherein said wire cores are comprised of a material selected from the group consisting of gold, copper, aluminum, and alloys thereof.

Claim 26 (Original): The microelectronic contact structure of Claim 22, wherein said shell is formed by plating said shell material onto said wire cores.

Claim 27 (Original): The microelectronic contact structure of Claim 22, wherein said at least one shell material is selected from the group consisting of nickel, tin, iron, cobalt, copper, silver, gold, platinum, tungsten, molybdenum, and alloys thereof.

Claim 28 (Original): The microelectronic contact structure of Claim 22, wherein said wire cores have a diameter less than a thickness of said shells.

Claim 29 (Original): The microelectronic contact structure of Claim 22, wherein said wire cores have a diameter greater than a thickness of said shells.

Claim 30 (Original): The microelectronic contact structure of Claim 1, further comprising said substrate joined to each of said column elements at said base thereof.

Claim 31 (Original): The microelectronic contact structure of Claim 2, further comprising said substrate joined to each of said column elements at said base thereof, and wherein said beam has a free end cantilevered from said group of column elements.

Claim 32 (Original): The microelectronic contact structure of Claim 31, wherein said microelectronic spring structure is configured such that said top of each of said column elements is substantially fixed while said free end of said beam will deflect under a force applied to said beam at said free end in a direction transverse to said substrate.

Claim 33 (Original): The microelectronic contact structure of Claim 32, wherein each of said column elements is connected at said base thereof to a terminal of said substrate, and further comprising a connector comprising a wire core joined to said terminal of said substrate, and connected to a second terminal of said substrate.

Claim 34 (Original): The microelectronic contact structure of Claim 1, wherein said contact element further comprises a plurality of beams, and wherein each of said plurality of beams is transverse to said column elements.

Claim 35 (Original): A substrate having a plurality of microelectronic spring structures mounted thereto, wherein each of said microelectronic spring structures comprises:

a group of column elements, wherein each column element has a top and a base, and is joined to said substrate at said base; and

a beam formed of a resilient material, and joined to each of said column elements in said group adjacent to said top thereof, whereby said beam is positioned transverse to each of said column elements.

Claim 36 (Original): The substrate of Claim 35, wherein said substrate comprises a probe card.

Claim 37 (Original): The substrate of Claim 35, wherein said substrate comprises a semiconductor material containing an integrated circuit.

Claim 38 (Original): The substrate of Claim 35, wherein said substrate comprises an interposer.

Claim 39 (Original): The substrate of Claim 35, wherein said substrate comprises a space transformer.

Claim 40 (Original): The substrate of Claim 35, wherein said substrate comprises an electrical connector.

Claim 41 (Original): A substrate-mounted microelectronic spring structure, comprising:

a substrate;

a substantially rigid column element having a top and a base, and joined at said base to said substrate, wherein said column element comprises a substantially straight segment of wire; and

a resilient cantilevered beam having a free end, and joined to said top of said column element at a joint a distance away from said free end;

wherein said microelectronic spring structure is configured such that said top of said column element is substantially fixed while said cantilever beam permits elastic deflection of said free end thereof under a force applied to said beam at said free end towards said substrate.

Claim 42 (Original): The microelectronic spring structure of Claim 41, wherein said column element is inclined to said beam at an angle between 70° and 110°.

Claim 43 (Original): The microelectronic spring structure of Claim 41, wherein said resilient cantilevered beam is sloped away from said substrate

Claim 44 (Original): The microelectronic spring structure of Claim 41, wherein said resilient cantilevered beam is contoured in a direction perpendicular to said substrate.

Claim 45 (Original): The microelectronic spring structure of Claim 41, wherein said resilient cantilevered beam is fabricated by a lithographic process that includes depositing said resilient material on a sacrificial substrate.

Claim 46 (Original): The microelectronic spring structure of Claim 41, further comprising a tip structure positioned on a surface of said beam opposite to said column element.

Claim 47 (Original): The microelectronic spring structure of Claim 41, wherein said tip structure is positioned adjacent to said free end of said beam.

Claim 48 (Original): The microelectronic spring structure of Claim 47, wherein said tip structure comprises a stand-off mounted to said beam, and a contact tip mounted to said stand-off.

Claim 49 (Original): The microelectronic spring structure of Claim 41, wherein said column element comprises a wire core enclosed in a shell comprising at least one shell material.

Claim 50 (Original): The microelectronic spring structure of Claim 49, wherein said shell is formed by plating said shell material onto said wire cores.

Claim 51 (Original): The microelectronic spring structure of Claim 49, wherein said wire core is ball-bonded to said substrate.

Claims 52-60 (Canceled)

Claim 61 (Original): A microelectronic spring structure, comprising:

substrate means for supporting a structure;

support means for supporting a beam, for securing a beam to said substrate means, and for elevating a beam above said substrate means; and
resilient beam means for contacting an electronic component, said resilient beam means supported by said support means.

Claim 62 (Original): The microelectronic spring structure of Claim 61, wherein said support means comprises a group of substantially rigid column elements.

Claim 63 (Original): The microelectronic spring structure of Claim 61, wherein said resilient beam means comprises a substantially straight beam of resilient material.

Claim 64 (Withdrawn): The microelectronic spring structure of Claim 61, wherein said resilient beam means comprises a beam of resilient material contoured in a direction perpendicular to said substrate.

Claim 65 (Currently amended): The microelectronic spring structure of ~~Claim 61~~ Claim 62, wherein each of said column elements of said group comprises a segment of wire.

Claim 66 (Original): The microelectronic spring structure of Claim 61, further comprising contact tip means for contacting a terminal of an electronic component, said contact tip means supported by and secured to said resilient beam means.

Claim 67 (Original): The microelectronic spring structure of Claim 66, wherein said contact tip means comprises a stand-off, and a contact tip mounted to said stand-off.

Claim 68 (New and withdrawn): The substrate-mounted microelectronic spring structure of Claim 41 further comprising a plurality of said column elements.

Claim 69 (New): The substrate-mounted microelectronic spring structure of Claim 41, wherein said substrate-mounted microelectronic spring structure includes only one column element.